
Annex G: Space

General

Successful Transformation to the Objective Force is the key to the Army's ability to sustain battlefield dominance in the 21st Century. This involves meeting the needs of current and future forces. Space-based systems are essential both for intelligence and communications connectivity, as well as other vital functions from navigation to targeting. Today's space capabilities make unique and essential contributions to our land force dominance. Through robust beyond line-of-sight connectivity and their ultimate high-ground perspective, space systems provide warfighters near and real-time situational awareness of force composition and disposition (red and blue), detailed knowledge of battlespace and associated environment, the status of support and sustainment efforts, and the linkages military leaders require to plan, execute, and sustain dynamic military operations.

Achieving the information superiority underpinning of *Joint Vision 2020* (JV 2020) and the lighter, faster, more lethal Objective Force will depend, to an even larger extent, upon the modernization of space-based capabilities.

Army Space Overview

Army space operations have traditionally focused on maximizing space capabilities in support of ground operations and supporting USCINCSpace in the four space mission areas:

- Force Enhancement
- Space Control
- Space Support
- Force Applications.

Force Enhancement is the largest area for Army use of space. It is value added to battlefield functions that helps the land force accomplish its terrestrial mission. As space capabilities and expertise mature, the Army continually upgrades its force enhancement capabilities. Space-enhanced improvements to these functional capabilities are key enablers to the Objective Force and therefore, key elements of Army Space modernization. Force Enhancement capabilities include communications; positioning, navigation and timing; weather, terrain, and environmental monitoring; intelligence, surveillance and reconnaissance (ISR); and missile warning.

As the Army grows more reliant on these enhanced capabilities, our vulnerability is also increasing. Rapid growth in commercial and international space capabilities increases a potential adversary's ability to monitor U.S. forces and potentially negate U.S. advantages in space. **Space control** takes on increased significance for land forces to ensure access to space capabilities. Space control is the means by which space superiority is gained and maintained to assure friendly forces can use the space environment while denying its use to the enemy. The four pillars of

space control the Army uses to retain assured access to space are:

- Surveillance of space—measures to monitor, detect, identify, track, assess, verify, and categorize threats and friendly spacecraft.
- Protection of U.S. and friendly ability to use space active and passive defensive measures to ensure that U.S. and friendly space systems perform as designed despite harsh environment and adversary negation attempts.
- Prevention—measures to preclude adversaries from exploiting U.S. or allied space services.
- Negation—measures against an adversary's space systems and services used for purposes hostile to U.S. national security interests, and supporting battle management, command, control, communications and intelligence.

The Army also plays a role in **space support** by conducting operations to deploy and sustain military and intelligence systems in space. The Army provides significant technology for space and missile system development; participates in joint space forums to articulate Army requirements for space platforms and architectures; and provides highly trained, space skilled members to the NASA astronaut program.

In the far-term, information assurance and anti-access strategy concerns may expand to include an Army role in **force application** from space and the Army's ability to coordinate and control effects of force application from space.

Space Modernization

The need for modernization of space capabilities to support the Objective Force is clearly explained in the concept for the Objective Force:

"The strategic landscape, organizations, technology and threats place greater demands on space-based capabilities than ever before. For the Objective Force, long-range communications, missile warning, terrestrial and space weather information, positioning and navigation, intelligence, reconnaissance, and space and terrestrial surveillance increasingly rely on space assets to provide the rapid real time support required by a strategically responsive force. To maximize the full combat capability of sensors and communications, the Objective Force requires linkage from the satellites down to the Soldier on the ground. Space communications provide an opportunity for command and control on the move, including the capability for en route mission planning and the ability to maneuver in compartmented and urban terrain. Space surveillance, reconnaissance, and tracking capabilities help provide the situational awareness to see and understand first—increasing lethality and survivability. Space assets also provide the capability for a smaller deployed footprint with 'reach back' and 'push forward' tailored communications capabilities."

“The careful design of space platforms to meet future requirements can also help reduce the design weight of ground systems. In addition, this increasing importance of space has not escaped the attention of our potential adversaries who have also begun examining and fielding ways to exploit space to benefit their aims. This emerging threat requires a capability for space control to deny potential adversaries the ability to see us, target us, and attack us from space. All of these demands make it essential for The Army to aggressively support efforts to improve and increase the space capabilities of the U.S.”

The Army's Investment Strategy for Space is to invest Army resources while influencing like investments by other space stakeholders. Investment objectives are to provide cost-effective, technologically feasible initiatives and research efforts that will enhance the emerging operational capabilities of Army units, meet responsibilities DoD has delegated to the Army, and achieve the Army's Transformation Strategy. While other services and government agencies have primary responsibility for space-based segments, the Army's programmatic emphasis is on space-related ground terminal development and wideband SATCOM payload control operations. To ensure the Army meets its responsibilities to the joint and combined force, and to ensure the Army ground components keep pace with space-based sensors and communications system improvements, a continuing effort to field enhanced tactical and fixed ground-based terminals, receivers, and

control systems is necessary. As Army space requirements increase, modernization interests expand to include other segments of space architectures and systems. There are increasing Army efforts to identify and leverage joint, commercial, civil, and allied space opportunities with operational and tactical warfighting potential. The Army is also an active participant in the design of joint and national space systems and architectures through National Security Space Architect (NSSA) orchestrated efforts. Army focus is on helping develop and integrate Army requirements to ensure joint, civil, and national space systems support land force mission needs.

Army space modernization planning takes its lead from the overall Army modernization strategy. The Army's concept and technology development efforts for space are directed at ensuring the necessary full spectrum capabilities will be available for the Objective Force to achieve the characteristics described in the Army Vision and execute the enhanced operational concepts of *JV 2020*. In the near-term, Army space systems are being upgraded to keep pace with user demands for accurate, secure, and timely information for the Legacy and Interim Forces. Preplanned product improvements to Army legacy systems are planned to take advantage of future architectures and spacecraft advances.

Doctrine

The use of space capabilities is becoming increasingly integrated into Army and joint doctrine. The quote from Field Manual 1 at the beginning of this

annex is indicative of the normalization and integration of space that is taking place throughout the Army. Army Space Policy requires that “the Department of the Army will conduct space and space-related activities that enhance operational support to warfighters and contribute to successful execution of Army missions.”

As joint space doctrine evolves, Army space doctrine is also better defined. The Army’s evolving space operations warfighting concept recognizes the importance of space capabilities to land force operations. It describes the future battlespace as a “seamless, vertical continuum” and recognizes that the land force commander must have timely and assured receipt of certain tactical information in the near-term as well as in support of the Objective Force. While the Global Information Grid infrastructure will eventually enable this capability, in the near to mid-term it may be necessary that ISR systems provide *direct access to tactical commanders in theater and direct control over limited effects* of space-based platforms. The concept also recognizes the interdependence of space systems and land force operations by articulating the operational requirement for each to support the other. Space-based systems are essential both for intelligence and communications connectivity as well as other vital functions from navigation to targeting. The Army will continue work with the joint community to achieve interoperability in this critical area. Conceptual analyses are also ongoing for joint space operations that may include force application from space in the context of effects coordination for land forces.

Organization

Because space capabilities are inherently joint and are spread over several Army battlefield operating systems, space capabilities support all the enhanced operational concepts of *JV 2020*. As a result, the overall, synergistic benefit of space capabilities is not always readily apparent. This diversity also means that coordination of space capabilities to achieve optimal utilization can also be a real challenge. To assist in this process, the Army has created a Space Operations Officer Functional Area (FA 40) within the information operations career field. The Army Space and Missile Defense Command (SMDC), the specified proponent for space and the integrator of space activities for the Army, is the proponent for this functional area.

Full integration of space capabilities in land force operations is essential to achieving the Army’s Transformation objective. To this end, the Army has embedded a Space Support Element (SSE) into the Interim Division design. SSEs are also being proposed in the corps redesign and for echelons above corps. Consisting of FA 40 Space Operations Officers and enlisted support personnel, the SSE will enable ground component commanders to fully exploit space system capabilities and products by bringing the specialized space operational expertise to bear in the planning and execution of land operations.

To provide space support capabilities that require high value, low-density equipment, Army Space Command forces, the Army service component for U.S. Space Command, are being

reorganized to provide deployable capabilities to the ARFOR, EAC or corps land component forces. These deployable capabilities include satellite communications, PNT accuracy information, missile warning and dissemination, access to digital terrain data, enhanced weather capabilities, access to ISR, space surveillance information, and commercial remote sensing space imagery. Future capabilities will include Space Control negation capabilities and access to hyper-spectral imagery.

Other FA 40s are being placed on tables of distribution and allowance throughout the Army, on the Army Staff, and on staffs of other high level agencies such as the Joint Staff, the National Reconnaissance Office (NRO), the National Imagery Management Agency (NIMA) and the National Space Architect's Office (NSSA), to articulate Army requirements, integrate Army space activities, and assure Army equities in the joint space arena.

Training

The Army is assessing its institutional training programs to determine the need for incorporation of a space-related core curriculum. This initiative proceeded, but is directly in line with, the Space Commission (Congressional Commission to Assess United States National Security Space Management and Organization) recommendations recently approved for implementation by the Secretary of Defense. Incorporating a balance of live, virtual, and constructive approaches, representative space operations training under consideration includes:

- Integration of space into Battle Command Training Program (BCTP).
- Space support to distance learning methods and programs.
- Space support to en route mission planning and rehearsal.
- Space support to in-theater split-based mission planning and rehearsal.
- Continued development of digitized terrain databases for global training and mission rehearsal.
- Use of space systems to facilitate training between the U.S. forces and its domestic and international partners.

Leader Development

The Space Operations Officer (FA 40) Basic Qualification Course at Army Space Command in Colorado Springs provides an education base and functional background for those assigned to FA 40 positions. To promote non-FA 40 leader understanding of space support to ground force operations and enhance general space-related awareness, the following leader development products/initiatives are being considered:

- A methodical examination of how adaptive technologies integrated into space-based communications and sensor systems can support mental agility and accelerated decision-making in tactical, operational, and strategic operations.
- Experimentation with space-based communications in support of split-based visualization and command

information procedures; use of global broadcast for these purposes; development of visualization and information technology-enabled leadership tools such as three-dimensional and holograph video-teleconferencing, illustration, and decision-support and planning tools.

- Articulation of Army requirements as a means of influencing joint tasking processes to ensure space systems are optimized in support of land forces.
- Placement of Army space operations personnel on joint staffs and selected other DOD or other agency or allied staff positions.
- Integration of space into Army leader development programs to include: Pre-Command Courses, SAMS, CGSOC, CAS3, the Sergeants Major Course, the Battle Staff NCO Course, and the BCTP.

Materiel

Space products and services enhance the effectiveness of individual Army systems by providing the advantages of the ultimate high ground while being *relatively* less vulnerable and politically encumbered than terrestrial or aerial systems. The systems that provide space capabilities to the warfighter have modernization programs to ensure the readiness of the Legacy and Interim Forces as well as to meet the demands of the Objective Force.

Army operational capabilities are often assessed along functional or battlefield operating system lines. Not a traditional operating system in its own right, space

significantly enables many traditional military functions. Modernization of space systems that provide enhanced operational capabilities must be synchronized with modernization of other Army systems and forces, and with joint space capabilities. Increasingly, commercial space initiatives will also augment military space.

Without going into system details, more fully addressed elsewhere in this plan, this annex touches on a variety of space-related systems to give readers a broad view of how Army space modernization contributes to the future success of land component forces to “see first, understand first, act first, and finish decisively.”

Communications

Army forces are dependent on electronic communications with operational concepts increasingly dependent on assured beyond line of sight (BLOS) communications. The SATCOM architecture provides the connectivity that enables forces to leverage all other space capabilities. Robust, reliable, space-based communications provide key capabilities to land forces.

The various military satellite communications (MILSATCOM) programs support communication requirements at all echelons during force projection. Included are secure, reliable, high-capacity (wide bandwidth and multichannel) service and en route mission planning and rehearsal capabilities. MILSATCOM, augmented by commercial space communications, enables logistics management by staffs in CONUS or other home bases, providing

the capability to exchange and update large databases between split-based elements. Supplies in transit or in-theater can be tracked by satellite-based communications linked to the global positioning system (GPS). Such capabilities reduce the footprint in theater by eliminating the need to stockpile equipment and containers. They also make logistics more agile, permitting en route visibility of assets and dynamic transport of supplies into theater. Added benefits are reduction in the in-theater force and strategic lift requirements as well as reduced vulnerability. The Global Broadcast Service (GBS) has the potential to support soldier services and provide a means to maintain current situational awareness on theater-specific information. Such capabilities are especially valuable during extended deployments involving the full spectrum of military operations from humanitarian assistance through major conflict.

To enhance the benefits of space-based communications in the Legacy and Interim Forces, the Army is fielding smaller, more versatile, more mobile, secure SATCOM terminals. The Legacy and Interim Forces will have improved capability to extend terrestrial networks, achieve BLOS requirements, enable reach back, reduce lift requirements, and improve data distribution to meet increasing voice, data and imagery transmission demands. Milstar satellites and terminals will provide Legacy to Objective Forces protected/anti-jam satellite communications currently not available to our tactical forces at corps and division level. Tactical SATCOM for the Objective Force will focus on increased capacity, integration, scalability, modularity, and mobility.

SATCOM connectivity will be a key enabler of battle command on-the-move to ensure Objective Force tactical commanders receive the right information at the right time without being tied to a traditional tactical command post. Army management of the communications payloads on new, more capable communications satellites will allow improved throughput between deployed forces and their sustaining base by several orders of magnitude to meet the requirements generated by new weapon platforms and operational concepts. Lastly, continued Army participation in the DoD wideband ground segment will ensure delivery of Defense Information Systems Network (DISN) services to the deployed warfighter.

Positioning, Navigation and Timing

All weather, accurate PNT provided by GPS satellites is critical to battlespace awareness, enhanced lethality, and survivability. GPS receivers enable elements to know precisely where they are, even when the surrounding terrain is unfamiliar, uncharted, or featureless. The user segment consists of receivers that accept the satellite signals and compute position and time for the user—a capability that enhances accurate blue force tracking (reducing and preventing fratricide), precision targeting, and synchronization on the battlefield. The GPS user equipment family consists of different models that meet a range of needs from the foot Soldier to high performance weapons platforms.

Embedded GPS receivers on weapons platforms and guided munitions support extended-range engagements required to shape the battlespace in depth.

BLOS blue force tracking systems integrate GPS and communications technology, enabling extended range reporting of friendly location and status. These systems also can provide a link between digitized and nondigitized forces such as Legacy Force and coalition members. On-going efforts to embed, integrate, and miniaturize GPS into our equipment and weapons platforms highlight the criticality of this capability across the spectrum of operations, and our increasing reliance on GPS satellites. Modernization efforts are focusing on embedded capabilities and protection of use of the PNT GPS system. In that future adversaries are likely to exploit urban and complex terrain for sanctuary, it is essential that ground forces be able to depend on consistent PNT GPS support in that environment. The Navigation Warfare (NAVWAR) program, directed by the Under Secretary of Defense (A&T) to address known GPS vulnerabilities, is now a component of the GPS modernization program. NAVWAR examined design alternatives to provide enhanced military performance and reduce vulnerability while maintaining uninterrupted civilian use. Greater host vehicle dynamics and the need for interfaces to other navigation, communication, or control systems will require enhanced capabilities for Objective Forces. The Army anticipates upgrading or replacing all Army GPS receivers during the FY03-11 timeframe.

Weather, Terrain, and Environmental Monitoring

Detailed, current knowledge of local terrestrial weather and its effects on operations enhances operational

planning. Tactical commanders need terrestrial weather information without the 4 to 6 hour latency imposed by the current 2 ball polar-orbiting Civil METSAT constellation. Plans to fly the National Polar-orbiting Operational Satellite System (NPOESS) will bring that constellation to 3, reducing the time delay between passes. The emerging capability to integrate near-real-time "tactical weather" from geo-stationary and polar-orbiting weather satellites will greatly enhance the planning capability of Legacy to Objective land forces by providing detailed, current knowledge of local weather conditions and high resolution information for input to centrally-prepared forecasting models. Modernization will provide current weather information and enhance dissemination so that it can be integrated more effectively into the battlespace planning process.

Through the use of ground segments such as small tactical terminals and integrated meteorological terminals (IMETS), space systems will provide information on conditions in remote contingency areas where surface observations do not exist. IMETS receives weather information from a range of weather input sources. These include relays or direct receipt from AF weather satellite equipment from polar-orbiting civilian and defense meteorological satellites, broadcasts from civilian forecast centers, the Air Force Weather Agency, and tactical relay from artillery meteorological sections and remote sensors. IMETS processes and collates forecasts, observations, and climatological data to produce timely and accurate weather products tailored to the specific warfighter's needs. Automated tactical decision aids provide significant

weather and environmental support to warfighters. Graphics displayed as part of a Common Tactical Picture will enable warfighters to see tailored weather effects on specific operations, weapon systems, personnel, and equipment.

Army forces also require on-demand, accurate terrain data and maps of specific theaters and areas of operations around the world. Digital terrain data is used in simulators to accomplish mission planning and rehearsals and to provide updated map products to land forces. Space assets provide the capability to meet that need. While currently limited to specific major theaters, evolving capabilities will provide global digital and 3D terrain products, enhancing battlefield visualization, operational planning, and targeting for Objective Force units.

Environmental monitoring capabilities of space assets will also provide key information to land force commanders. Our ability to conduct intelligence preparation of the battlespace for the Objective Force can be enhanced by hyper-spectral imagery (HSI) from space. HSI allows us to detect environmental changes that heretofore could only be detected by Soldiers on the ground (usually too late to have been considered in any operational planning). Additional capabilities include soil saturation monitoring for trafficability analysis, man-made or natural obstacle detection and avoidance, and observation and prediction of the effects of weapons of mass destruction. Current warfighter experiments, which leverage civil and commercial space assets, are examining the use of HSI to support the warfighter. As the technology develops, this capability will be integrated into the

planning process to support the Objective Force.

There are a number of phenomena that occur on the surface of the Sun and in space that, can have a dramatic effect on communications, GPS signal reception, and radar systems. Knowledge of these "space weather" events and assessment of when, how, and to what degree friendly systems will be affected allows commanders to plan around periods of signal interruptions.

Intelligence, Surveillance, and Reconnaissance (ISR)

Space assets allow us to "see and hear" the enemy from the ultimate high ground without putting Soldiers at risk. On-demand, tailored ISR data is key to the tactical level commander's decisive action, information dominance, and high operational tempo (OPTEMPO) including a battle rhythm with short decision cycles. Getting timely information with assured receipt to the warfighter is a key focus of Army Space Modernization. The near-term strategy to modernize ISR assets is to reduce the number of systems involved in receiving and disseminating ISR data for the land component commander. Satisfaction of the need for timely and assured receipt of key ISR data may require theater downlink and dynamic tasking and retasking capability for ISR assets. Mobile, dynamic networks and the seamless integration of terrestrial, airborne and space communications will allow information to be distributed among sensors, warriors, weapons platforms, and support bases so that land force commanders can exploit "speed" and "knowledge" to increase Objective Force OPTEMPO information.

The situational awareness enabled by Army tactical exploitation of national capabilities (TENCAP) provides Legacy and Interim Forces early and continuous battlespace visualization. The Tactical Exploitation System, a TENCAP initiative, provides a highly deployable, integrated, scaleable intelligence system specifically designed for split-based operations. Emerging versions will have robust global and tactical communications connectivity. It serves as a preprocessor of the All Source Analysis System, the JSTARS common ground station, and the Digital Topographic Support System.

Future space sensors will detect ground targets, and link through Distributed Common Ground System - Army (DCGS-A) to assure timely target information to the tactical warfighter. Access to a growing array of commercial imagery products will also be available through efficient downlinks embedded in the DCGS-A.

Objective Force command, control, communications, computers, intelligence, surveillance, and reconnaissance (C4ISR) systems, embedded at all echelons, must fit seamlessly within the joint structure, including space assets, and be effective even in a degraded environment. The Army will continue work with the joint community to achieve interoperability in this critical area.

Missile Warning

The joint tactical ground station (JTAGS) directly receives tactical ballistic missile launch data collected by Defense Support Program surveillance satellites. JTAGS enables early warning to deployed forces

by providing the theater commander an in-theater processing capability that computes the estimated launch point and predicted impact area. This supports implementation of timely passive defense measures, as well as the execution of joint theater missile defense (JTMD) attack operations that may include unmanned aerial vehicles (UAV), special operations forces, Apache helicopters, and Army tactical missile systems. Expanded battlespace and efficient fire distribution for Patriot and other active defense systems, including their ability to “slew-to-cue” can also be supported by JTAGS. In the near-term, space-based infrared system (SBIRS) surveillance satellite data processed through the improved JTAGS, with multi-mission mobile processor (M³P) configuration, will provide increased accuracy and timeliness of: launch point estimation, impact point prediction, and cueing and alerting data provided to warfighters and weapon systems.

Space Control

Future military operations can assume neither uninterrupted nor sole access to space products. As more nations gain access to space capabilities, the need to ensure U.S. access to space will become a military necessity. There is already wide availability of global, satellite-based communications systems that have military utility, and the availability of high-resolution commercial imaging is a source of great concern. As order-to-delivery times decrease, commercial imaging systems will be capable of providing tactically significant products to potential adversaries. Common access to space capabilities will challenge, perhaps even limit U.S. ability to achieve

strategic surprise. These capabilities could assist an adversary's implementation of an anti-access strategy and potentially limit U.S. military options. Space control will be an essential element in ensuring theater access, access to space and space capabilities, and land force information superiority. Part of the Army's space modernization program is to develop the suite of technologies and DTLOMS solutions to assure access to required space capabilities for the Objective Force while denying the same to any adversary. Future Army operations and equipment will require information operations methods that protect our space capabilities, exploit an adversary's space capabilities, and protect friendly forces from space-based observation. These methods will include capabilities for in-theater space surveillance; protecting vital command communications/intelligence surveillance and reconnaissance (C3ISR) assets; and deceiving, denying, degrading, disrupting and/or destroying an adversary's space systems when directed.

Soldier

OPMD XXI established the Space Operations Officer (Functional Area 40) as part of the information operations career field. This developing cadre of space professionals plays an increasingly important role in the Army Transformation. In addition to identifying and designating or converting additional positions for FA 40s throughout the Army and joint agencies, additional FA 40 designee positions have been identified to better prepare officers for the highly skilled FA 40 positions. Additional advanced civil schooling and training with industry

requirements are also being identified. A project development skill identifier has also been established to enable a study of military occupation specialty (MOS) skills necessary for Soldiers working in a space environment. This study will assess the need for an additional space related-MOS.

Summary

As critical components of both peace-keeping and wartime combat, combat support, and combat service support processes, space-based systems will host substantial force enhancement capacity that will deliver vastly improved connectivity, situational awareness, decision support system assistance, and BLOS precision engagement capabilities to Transformation Forces. Those enhancements will enable and underwrite the success of future Objective Force units operating in a distributed, network-centric, non-linear environment. To assure access to these space capabilities and deny those benefits to adversaries, Army ground forces will provide in-theater space control capabilities developed in concert with other service efforts.

Army space modernization is on the right azimuth but is still in its infancy. Continued efforts to understand Army equities in space, translate those equities into validated requirements, and integrate those requirements into Army and joint programs and architectures are integral to the successful execution of the Army Transformation Campaign Plan.

Adherence to Army and joint requirements generation system procedures ensures that doctrine,

training, leader development, organization, and Soldier solutions are considered before materiel solutions.

Priorities

Army Space Modernization efforts to enhance warfighter support from space focus on establishing information superiority and enabling the enhanced operational concepts of *JV 2020*. Army space modernization priorities are:

- Support satellite communications growth and connectivity to meet DoD delegated MILSATCOM responsibilities and the C4 requirements of Army Transformation.
- Improve the timeliness and assured receipt of ISR capabilities to the warfighter to meet the tactical ISR requirements of Army Transformation.
- Assure ground force receipt of continuous PNT data in all operational environments and resolve GPS vulnerability to jamming in the near-term.
- Develop space control capabilities to assure access to key space capabilities and deny access to our adversaries.
- Provide timely and assured missile warning (SBIRS and M3P) to Army Transformation forces.
- Provide timely weather, terrain, and environmental monitoring data in support of tactical ground force operations.
- Provide assured BLOS BFT capabilities to forces outside the range of organic ground force C3 networks.